Name: Dr. Leslie Suters

LESSON PLAN

Name: Dr. Leslie Suters **Date: 2/8/12**
Subject: Science **Grade Level:** 4th **Length of Lesson:** 90 minutes
Lesson Plan Title: Electrical Circuits and Electromagnetism
Content Standard: 12.0 Forces in Nature
Materials & Resources: *Per Group*: Energy Ball, batteries (4-5), Wire clips, Long strip of insulated wire, iron bolt, paper clips, sockets, light bulbs, motors, switch
Per person: Scissors & paper for making foldable

PLANNING

Unit Goal(s):
GLE 0407.12.2 Observe that electrically charged objects exert a pull on other materials.
GLE 0407.12.3 Explain how electricity in a simple circuit requires a complete loop through which current can pass.

Learning Objectives:
The learner will:

- perform an experiment to determine how electricity flows through a circuit in 2 ways: series & parallel.
- observe that electrically charged objects exert a pull on other materials.
- explain how electricity in a simple circuit requires a complete loop through which current can pass.

Checks for Understanding
0407.12.1 Explore the interactions between an electrically charged object and other materials.
0407.12.2 Design an experiment to investigate how a simple electromagnet affects common objects.
0407.12.3 Describe how electricity passes through a simple circuit that includes a battery, wire, switch, and bulb.
SPI's
SPI 0407.12.2 Determine how an electrically charged material interacts with other objects.
SPI 0407.12.3 Determine the path of an electrical current in a simple circuit.

Enduring Understandings:
CONCEPT(S):
Closed Circuit: Connection between the sources of electricity and the appliance or device is continuous; turned on
Open Circuit: a break or gap in the circuit; the flow of electricity stops
Switches: safe and convenient way to open or close circuits
Batteries: called dry cells; D-size or #6 are safest - deliver 1 1/2 volts of electricity
Bulbs: Match the bulb with the # of 1 1/2-volt cells used; Commonly you will use bulbs labeled as one-cell or 1.2V and two-cell or 2.5V
Fahnestock (Wire) Clips: Used to make connections to sockets and wires
Wires can be connected in series (one loop, such as outdated Christmas Tree lights) or parallel (2 or more loops, such as wiring in houses)
Cells (or batteries) can be connected in series (negative terminals join to positive terminals) or parallel (like terminals are joined)
Electromagnet: a temporary magnet made by coiling wire around an iron core; when current flows in the coil the iron becomes a magnet

ESSENTIAL QUESTIONS:
Knowledge: What is a simple circuit?; What is a series circuit?; What is a parallel circuit?; What is an electromagnet?
Comprehension: What can be used to make an electromagnet? Series circuit? Parallel circuit?

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Application: Show me how to create a series circuit.; parallel circuit; electromagnet. What happens if you remove a light bulb from its socket when you have 2 or more items connected in series? In parallel?
Analysis: Where do we see series circuits in use?; Where do we see parallel circuits in use?
Synthesis: What might happen if you used more than one battery with your electromagnet? What would you infer about how series and parallel circuits work from your observations?
Evaluation: Do you agree that life is better with electricity? What criteria would you use to assess the understanding of your peers regarding electrical circuits?

Interdisciplinary Connections:

Math: Students can tally the number of paper clips that their electromagnet holds with one, two, and three batteries and then create a graph to display the information.
GLE 0406.5.1 Collect, record, arrange, present, and interpret data using tables and various representations
SPI 0406.5.1 Depict data using various representations (e.g., tables, pictographs, line graphs, bar graphs)

Social Studies: Discuss what life was like before electricity.
Learning Expectation 5.05 Understand the place of historical events in the context of past, present and future.
4.5.spi.4. Determine the hardships faced by early Tennessee settlers in the late 1700's (i.e., security, isolated communities, lack of access to goods, natural geography)

Language Arts: Oral skills and listening skills are necessary for any type of experiment where the students will be communicating with each other to figure out a solution to their problem. Use of logic is needed to effectively communicate the solution both orally and in writing.
GLE 0401.2.1 Continue to develop oral language skills necessary for communication.
GLE 0401.2.2 Continue to develop listening skills necessary for communication.
GLE 0401.5.1 Continue to develop logic skills to facilitate learning and to enhance thoughtful reasoning.
GLE 0401.5.2 Use logic to make inferences and draw conclusions in a variety of oral and written contexts.
GLE 0401.5.3 Apply logic skills to classroom situations and to selections read.
SPI 0401.3.1 Identify the purpose for writing
SPI 0401.5.1 Locate information to support opinions, predictions, and conclusions.
SPI 0401.6.5 Interpret information using a chart, map, or timeline.

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INSTRUCTION

INTRODUCTION or Anticipatory Set **Time: 10 minutes**

Engage:

Part I. Ask each group to find creative ways to activate the energy ball. Share findings with class. Ask class to join hands and activate one energy ball. Ask one person to let go – what happens to the energy ball (stops working). Discuss open and closed circuits. (5 min)

Part II. *Batteries, Wires, and Bulbs* Formative Assessment Probe (*FACT #14 Familiar Phenomenon Probes*). Display question on document camera and allow class to answer individually, pair to discuss, and then share with class. (FACT #61 Think-Pair-Share) Allow class to test their predictions briefly. (5 min)

BODY (Activities & Practice)

Activities **Time: 70 minutes**

Explore I: (20 minutes)

Use a guided inquiry format to ask groups to find 2 different ways to light 2 bulbs or a bulb & a motor with the use of the at least 3 wires and a switch.

Explain II: (15 minutes)

Students share their discoveries in finding different ways to light their bulb or start a motor.

At this time the teacher will share the terms for the 2 types of circuits that the students discovered. Series (one loop) and parallel (2 or more loops).

To record their findings the students will create a graphic organizer. Students should get a piece of colored paper and fold it in half, hot dog style, and then cut slits only on the top sheet of the paper so that they have three even flaps on the top. On flap one, students should write "series", on flap two students should write "parallel". Underneath each flap students should draw what they created, labeling each part of their drawings. The 3rd flap will be completed later.

Explore II: (10 minutes)

Ask the students to construct an electromagnet using one wire, one bolt, and one battery. Explore picking up paper clips with the electromagnet.

Explain II: (5 minutes)

Students share their observations from their construction of the basic electromagnet. Teacher will direct the students to write "electromagnet" on flap 3 of their graphic organizer. Underneath the flap students should draw and label an electromagnet.

Extend: (20 minutes) Ask students to extend their learning by exploring further with their choice or series & parallel circuits or electromagnets. Student findings should be written in learning logs.

Series & Parallel Circuits: With the supplies provided, what can you do to make the light bulb brighter or the motor turn faster? What happens when you add more batteries? Why do you think this happened? Work together in your group to see what you need to do to make the light bulb as bright as possible. What happens if you remove a light bulb from its socket when you have 2 or more items connected in series? In parallel?

Electromagnets: Does the location of the wire determine the strength of the electromagnet? Work together in your group to determine the different ways that you could arrange the wire to pick up as many paperclips as possible. How many could you pick up if the wire was at the top? How many with the wire in the middle? How many with the wire at the bottom? Does using more batteries increase the strength of your electromagnet.

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Practice/Assessment **Time**: 5 minutes (in-class; can take home and complete if needed)

Evaluate

Ask students to complete a 3-2-1 assessment (FACT # 64) in their learning logs.

- Write 3 things you learned about circuits today. Be as specific as possible and include sketches to illustrate.
- Write 2 things you learned about electromagnets today. Be as specific as possible and include sketches to illustrate.
- Write 1 thing that you would like to explore further about circuits or electromagnets that we did not get to do today.

Note: The learning logs will be collected and reviewed the following day in class.

CLOSURE **Time: (5 minutes)**

Refer to essential questions. Ask class at least one question from each level. Allow students to turn to their shoulder partner and respond to the questions initially and then share selected responses with whole class.

ASSESSMENT

Evaluation:

Informal:

The teacher will circulate around the room and talk with students as they experiment. Teacher will determine student understanding during explain portions of lesson through discussion.

Formal:

The teacher will review the graphic organizers and the 3-2-1 assessment completed by each student for accuracy.

Alternative and/or Supplemental Activities/Extensions:

Part I. E-Learning – During learning center time allow students to explore the following sites. These sites will be bookmarked on class webpage so students can explore them at home as well.

1. How Electromagnets Work

Includes a clear description of how they work, magnetic fields, the coil of the electromagnet and experiments to try.
http://science.howstuffworks.com/electromagnet.htm

2. Switched on Kids

Great kid friendly website that explains electricity.
http://www.switchedonkids.org.uk/

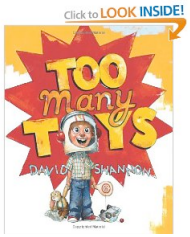
3. Circuit Builder

This is a great game that kids can play to understand what make a strong and weak circuit by telling whether they think the bulb will be bright or dim.
http://www.bbc.co.uk/schools/podsmission/electricity/annie03.shtml

4. Electricity Teaching Resources

This website has some great games that allow the children to explore different parts of electricity, circuits, and conductors.
http://primaryhomeworkhelp.co.uk/revision/Science/electricity.htm

Part II. Explore Electronic Toys – Ask students to bring old electronic toys (no longer being used) that can be taken apart to class. The teacher will also buy kits that students can use to build a solar-powered car or toy. Initiate these activities by reading: *Too Many Toys* (2008) by David Shannon



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Differentiation – Accommodations for Individual Learners:

Bodily-Kinesthetic: Students are actively constructing circuits and electromagnets with their hands.
Intrapersonal: Students will be working in groups to complete the tasks
Interpersonal: Students will complete their own graphic organizers and 3-2-1 assessments
Logical-Mathematical: Students record findings in their learning logs as they complete the extension portion of the lesson. The data can be used later to make graphs.
Spatial: Students complete sketches in their graphic organizers

References:

Ansberry, K. & Morgan, E. (2010). *Picture-Perfect Science Lessons - Expanded 2nd Edition: Using Children's Books to Guide Inquiry, 3-6*. NSTA Press

- Lesson included in book for *Too Many Toys*

Keely, P., Eberle, F. & Farrin, L. (2005). *Uncovering Student Ideas in Science, Vol. 1: 25 Formative Assessment Probes*. NSTA Press

- *Batteries, Wires, and Bulbs* Formative Assessment Probe

Peters, J.M. & Stout, D.L. (2011). *Science in Elementary Education: Methods, Concepts, and Inquiries, Eleventh Edition.* Allyn & Bacon.

- Used for Concepts included in Enduring Understandings section of plan